PHILIPS

Xitanium

LED SR driver

Design-in Guide

Reliable SR technology for connected LED applications

December 2016

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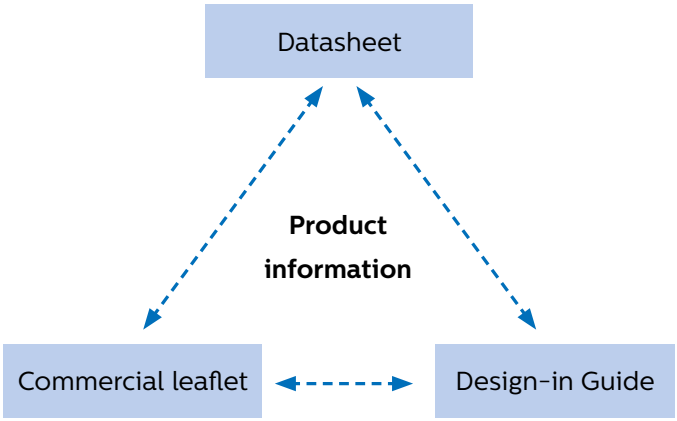


Thank you for choosing the Philips Xitanium LED Sensor Ready drivers (SR). In this guide you will find the information needed to integrate these drivers into a LED luminaire or LED system.

This edition describes the Xitanium LED SR drivers. We advise you to consult our websites for the latest up-to-date information.

Applications

Philips Xitanium LED SR drivers reduce complexity and cost of wireless connected lighting systems in indoor, outdoor and industrial applications. If you use Philips LED SR drivers in combination with Philips LED modules, specific design-in guides are available from the below mentioned technology websites.

Information and support

Please consult your local Philips office or visit:
www.philips.com/technology
www.philips.com/multione

Design-in support

On request Design-in support from Philips is available. For this service please contact your Philips sales representative.

Document overview

In order to provide information in the best possible way, Philips' philosophy on product documentation is the following.

- Commercial leaflet contains product family information & system combinations
- Datasheet contains the product specific specifications
- Design-in guide describes how the product is to be designed-in

All these documents can be found on the download page of the OEM website www.philips.com/technology. If you require any further information or support please consult your local Philips office.

Safety Precautions

Warning:

- Avoid touching live parts!
- Do not use drivers with damaged housing and/ or connectors!
- Do not use drivers with damaged wiring!
- Turn off DALI power supply when using the driver as a standard DALI driver!

Safety warnings and installation instructions

- Do not use damaged products
- The luminaire manufacturer is responsible for his own luminaire design and has to comply with all relevant safety standards
- The Xitanium LED SR drivers are suitable for built-in use only and must not be exposed to the elements such as snow, water and ice or to any other chemical agent which can be expected to have an adverse effect on the driver (e.g. Corrosive environments). It is the responsibility of both luminaire manufacturer and installer to prevent exposure. The suggested minimum luminaire IP rating in the driver datasheet serves only as guidance and a higher IP rating may be required under certain application conditions. Common sense needs to be used in order to define the proper luminaire IP rating.
- Do not service the driver when the mains voltage is connected, this includes connecting or disconnecting the LED module.
- No components are allowed between the LED driver and the LED modules other than connectors and wiring intended to connect the LED driver to the module.
- Please provide adequate earth and/or equipotential connections whenever possible or applicable.
- Cap off all unused wires from the driver to prevent accidental contact with the luminaire or driver housing.

Philips Design-in support is available; please contact your Philips sales representative.

Introduction to Xitanium LED SR drivers

Xitanium LED SR Drivers

Xitanium LED SR drivers

Xitanium LED SR drivers are designed to operate wireless connected LED solutions for general indoor, outdoor and industrial lighting applications such as offices, public buildings, shops, streets, roads and warehouses. In the coming years LEDs will continue to increase in efficiency, creating generation and complexity challenges for OEMs. With Xitanium LED SR drivers, flexibility in luminaire design is assured thanks to an adjustable output current. In addition, with the SR interface it is simpler than ever to connect city management system (CMS) controllers and sensors. Application-oriented operating windows offer the flexibility required to provide the stable lumen output and light quality levels that lighting specifiers and architects demand. The adjustable output current also enables operation of various LED PCB solutions from different manufacturers.

Xitanium LED SR driver versions

The Xitanium LED SR drivers described in this guide are available in multiple power and current ratings which enable the most popular light output levels for indoor, outdoor and industrial applications. Please note that there are different drivers for indoor applications and different ones for outdoor and industry applications. It is always highly recommended to check our latest Xitanium LED SR driver leaflet for the most up-to-date overview of our range. This leaflet can be downloaded at: www.philips.com/technology

Detailed specifications can be found in the Xitanium driver datasheets which can be downloaded at www.philips.com/technology. You can also view product specifications and access the datasheets via the Easy Design-in tool at www.easydesignintool.com.

Features

Configurability Interface (tooling)

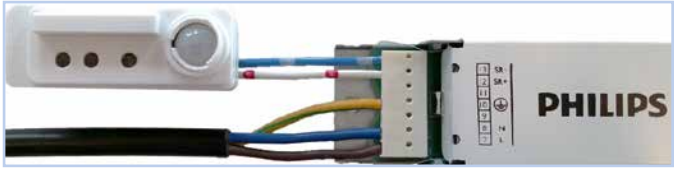
The Xitanium LED SR drivers are programmable. A large package of features and parameters in these drivers can be set via a specific tool. This tool is the MultiOne Configurator. There are two types of interfacing technology used to communicate with this tool:

- SR interface (based on DALI protocol)
- SimpleSet (New)

SimpleSet

Philips SimpleSet new NFC wireless programming technology allows luminaire manufacturers to quickly and easily program Xitanium LED SR drivers in any stage during of the manufacturing process, without a connection to mains power, offering great flexibility. As a result, orders can be met faster while reducing cost and inventory.

For more information, please visit www.philips.com/multione or contact your local Philips representative.



SR driver connected to a sensor

Sensor Ready Interface

Xitanium LED SR drivers reduce complexity and cost of luminaires used in (wireless) connected lighting systems. They feature a digital SR interface to enable direct connection to any suitable CMS (City Management System) controller or sensor (see Figure on the left that uses the example of an indoor SR driver). Functionality integrated into the SR driver eliminates auxiliary components such as power supplies and relay boxes used in many typical outdoor lighting controllers (OLC) today. The result is a simpler, less expensive luminaire that enables turning every luminaire into a wireless node and a more reliable DC powered controller.

The simple two-wire SR interface supports these key functions:

- Switchable built-in SR bus power supply to provide power to the connected control device (e.g., an RF module or an OLC))
- Two-way digital communication between the SR driver and control device, using standard DALI 2.0 protocol
  - Standard DALI dimming, ON/OFF and control functions
  - Power and energy reporting utilizing the power monitoring integrated in the driver
  - Diagnostic information

These functions are described further in the document.

Auxiliary Power Supply

Next to the SR bus power supply, the outdoor and industry driver is equipped with a non-switchable internal 24 VDC power supply which is intended to power auxiliary luminaire devices that need more power than the SR bus can deliver. This supply can deliver 3 W continuously and 10W peak with a duty cycle of 25% (T = 5.2 ms). This supply shares its common with the SR bus supply common.
In case of a short – circuit, the light will switch off.
Note: It is not allowed to put the auxiliary power of one driver in parallel to another driver.

Adjustable Output Current (AOC)

Flexibility in luminaire design is ensured by the adjustable output current (AOC). The adjustable output current enables operation of various LED configurations from different LED manufacturers whilst also ensuring the solution remains “future proof” for new LED generations. The output current can configured with the Philips MultiOne Software and the SimpleSet interface.
More information about AOC and how to set the output current can be found in the chapter “Electrical design-in”. Information about configuring drivers with SimpleSet can be found in the chapter “Configurability”.

LED Module Temperature Protection (MTP)

Thermal protection of LED modules is possible by integrating a NTC (Negative Thermal Coefficient) resistor in the LED PCB. More details about the NTC resistor can be found in the Chapter “Thermal design-in”.

Dimming interfaces

Interfacing with the Xitanium LED SR drivers can be done via the SR interface.

Amplitude Modulation (AM) output dimming

Philips Xitanium LED SR drivers dim the output to the LEDs by means of Amplitude Modulation (AM) dimming. This means that at no stage of the dimming, Pulse Width Modulation (PWM) at the output to the LEDs is involved. AM dimming guarantees the most smooth and flicker-free operation over the entire dimming range.

Hot wiring

Xitanium LED SR drivers cannot be serviced, connected or disconnected from the LED module when the mains voltage is connected. Please make sure that power is turned off when working on a Xitanium driver.

DC mains operation

Xitanium LED SR drivers are allowed to be connected to a DC power grid (e.g. central emergency system). The driver behavior once switched to DC input voltage can be programmed via MultiOne software. More details about DC input voltage suitability can be found in the driver datasheet.

Constant Light Output

Traditional light sources suffer from depreciation in light output over time. This applies to LED light sources as well. The CLO feature enables LED solutions to deliver a constant lumen output throughout the life of the light engine. Based on the type of LEDs used, heat sinking and driver output current, a correction of the lumen depreciation can be entered into the driver. The driver then counts the number of operating hours and will correct the output current based on this input.

Since the CLO curve is not generic, the OEM needs to determine the appropriate CLO curve. This can be used to differentiate on e.g. lumen output or power consumption over lifetime.

The CLO feature can be programmed with the Philips MultiOne configurator tool. More information can be found on: www.philips.com/multione.

OEM Write Protection (OWP)

OWP allows the OEM to protect their driver setting over the lifetime of the driver by using a password.
Drivers equipped with OWP will show this in the feature list if read out by the tool MultiOne.
Specific feature and also the OWP can be enabled and protected with that password to prevent unauthorized changes.
The password management is under the responsibility of the company which is setting it.

Driver diagnostics

Xitanium LED SR drivers offer a Diagnostics feature. The purpose of Diagnostics is to gather information and help diagnose the history of the driver and connected LED module. The Diagnostics feature consist mainly of counters which keep track of specific variables like the number of startups of the driver, operating hours, temperature of driver and LED modules, current and voltages etc.

More information on the diagnostics see instruction manual of MultiOne Engineering at:
www.philips.com/multione

When the driver is shutdown the diagnostics data is stored automatically in non-volatile memory.
Diagnostics can also be accessed through the SR interface with a password provided to SR Certified partners.

Energy Metering

The SR driver has built-in energy measurement capability and can report energy and actual power consumption. Accuracy of power measurement is higher of following 2 values: 0.5W or +/-1 % measured input power. This feature stores parameters in the nonvolatile memory bank provision specified in the DALI 2.0 standard and the SR Certified specification.

Explanation of the Driver Naming

The names of the drivers are described as shown in the examples below:

Indoor SR Drivers

Example : Xitanium 36W 0.3-1A 54V SR 230V

Xitanium	: Concept name for highly efficient and reliable drivers
36W	: Maximum output power
0.3-1A	: Adjustable output current range
54V	: Maximum output voltage
SR	: Sensor Ready
230V	: Mains AC input voltage

Outdoor and Industry

Example : Xi XX 150W 0.2-0.7A SNEMP 230V S240 sXt

Xitanium	: Concept name for highly efficient and reliable drivers
XX	: Driver Family Sensor ready (SR)=Window driver (AOC, SR Interface, CLO, DynaDimmer) Full Prog (FP)= Window driver (AOC, CLO, DynaDimmer) Lite Prog (LP)= Window driver (AOC, CLO Lite, DynaDimmer Lite)
150W	: Maximum output power
0.2-0.7A	: Adjustable output current range
SNEMP	: Hardware features S = SimpleSet N = NTC input L = LineSwitch 1 = 1-10V interface D = DALI Interface A = AmpDim E = DC Emergency M = EnergyMetering P = Auxiliary Power supply
230V	: Mains AC input voltage
S240	: Housing S175, C150, S240, (S=Stretched, C=Compact, ###=length in mm)
sXt	: Protection sXt=100 khrs, Surge immunity CM/DM = 8..6 kV/6 kV

Mechanical Design-in

SimpleSet interface tool LCN9620

SimpleSet Interface tool LCN9610

Form factors

Xitanium LED SR drivers will become available in different housing dimensions. The specific dimensions can be found in the driver datasheet. 3D CAD files are available as well to verify fitment and can be found at www.philips.com/technlogy.

Drivers need to be built in such that the driver housing and the driver input and output connectors are not affected by potential water ingress in the luminaire (e.g. due to luminaire sealing malfunction or condensation).

It is highly recommended to mount the driver by using all available mounting feet in order to achieve maximum mechanical robustness against shocks and vibration. The recommended mounting torque is 1.5 Nm. This value should not be exceeded in order to prevent deformation of the mounting feet. The use of rivets is not recommended since mounting torque cannot be controlled; damage to the mounting feet or loose mounting may result.

Mounting screw dimensions should be based on the specified fixing hole diameter in the driver datasheet. Oversized and undersized screws should not be used in order to prevent damage to the mounting feet or loose mounting.

Please allow for sufficient free space around the driver SimpleSet antenna if the driver is to be configured after mounting in the luminaire. The minimum recommended space is depending on the type of SimpleSet configuration tool. Using the tool as shown here (LCN9620), the minimum distance is 19 mm (+/-1mm).

Depending on the application and the use in development, factory or field, another configuration tool can be selected. Please check the website www.philips.com/multione to find the correct type.
Every published interface tool is officially approved for use with the MultiOne software. The tool type number can be found by checking the LCN label on the tool itself.

Note: the use of an unapproved tool may result in wrong or bad connection and configuring malfunctioning.

In order to familiarize oneself with SimpleSet a free SimpleSet engineering tool is available from our local Philips representative. This engineering tool is not intended for production or field service purposes but for engineering testing only.

Thermal Design-In

Introduction

This chapter describes two aspects of the thermal design of the Xitanium SR LED drivers:

1. The LED driver itself and relationship between Tc point and lifetime of the LED driver
2. Module Temperature Protection (MTP) function to ensure lifetime of LED module/PCB.

To facilitate design-in of LED drivers, the critical thermal management points of the LED driver are set out in this section. In Philips' product design phase all possible precautions have been taken to keep the component temperature as low as possible. However, the design of the luminaire and the ability to guide the heat out of the luminaire are of utmost importance. If these thermal points are taken into account this will ensure the optimum performance and lifetime of the system.

Driver case Temperature Point (Tc point)

To achieve optimal lifetime and reliability, it is critical that the temperature of the components in the driver remains within its rating.

The case temperature (Tc) is a reference for the temperatures of the critical internal driver components. The location of the Tc point is identified on the product label. Tc point is marked by the *-sign on the label of the driver.

To measure Tc at the Tc point

The temperature can be measured using a thermocouple that is firmly glued to the driver housing. For a representative measurement the temperature must be stable before any reliable data can be obtained (typically > 3 hours).

Note: Xitanium SR drivers allow for a driver-internal temperature readout through the MultiOne Diagnostics feature. This readout does not present the driver Tc point temperature and should not be used to define thermal suitability of the driver in the application.

Relation between Tc and ambient temperature

The Tc increases, by approximation, linearly with the driver ambient temperature (Tamb). The temperature offset between driver Tamb and Tc depends on the thermal design of the luminaire and the actual delivered output power relative to the specified nominal output power.
A lower output power allows for a higher driver ambient temperature as long as the maximum specified driver Tc is not exceeded. For the approved driver ambient temperature range as well as specified Tc point values please check the specific driver datasheet.

Module Temperature Protection (MTP)

NTC and thermal design

This feature helps to protect the LEDs when operated during abnormal thermal application conditions. The thermal design of an LED module/PCB should be designed in such a way that the temperature of the LED module (Tc-life) is not exceeded under normal application conditions. The utilization of an NTC (Negative Temperature Coefficient resistor) serves the purpose to help achieve the lifetime of the LED module if external thermal influences result in the temperature for lifetime (Tlife) being exceeded. When this occurs the light output will be regulated down to remain below the critical temperature of the LEDs.
The following three NTC part numbers are supported in combination with Philips SR LED drivers:

1. 10 k NTC - Murata, part number NCP18XH103J03R
2. 15 k NTC - Vishay 15 kOhm , part number NTCS0805E3153GMT (previous p/n: 2381 615 54153)
3. 15 k NTC - Murata, part number NCP15XW153E03RC (with a separate 390 ohms fixed-value resistor in series with the NTC)

Setting MTP behavior (programmable drivers only)

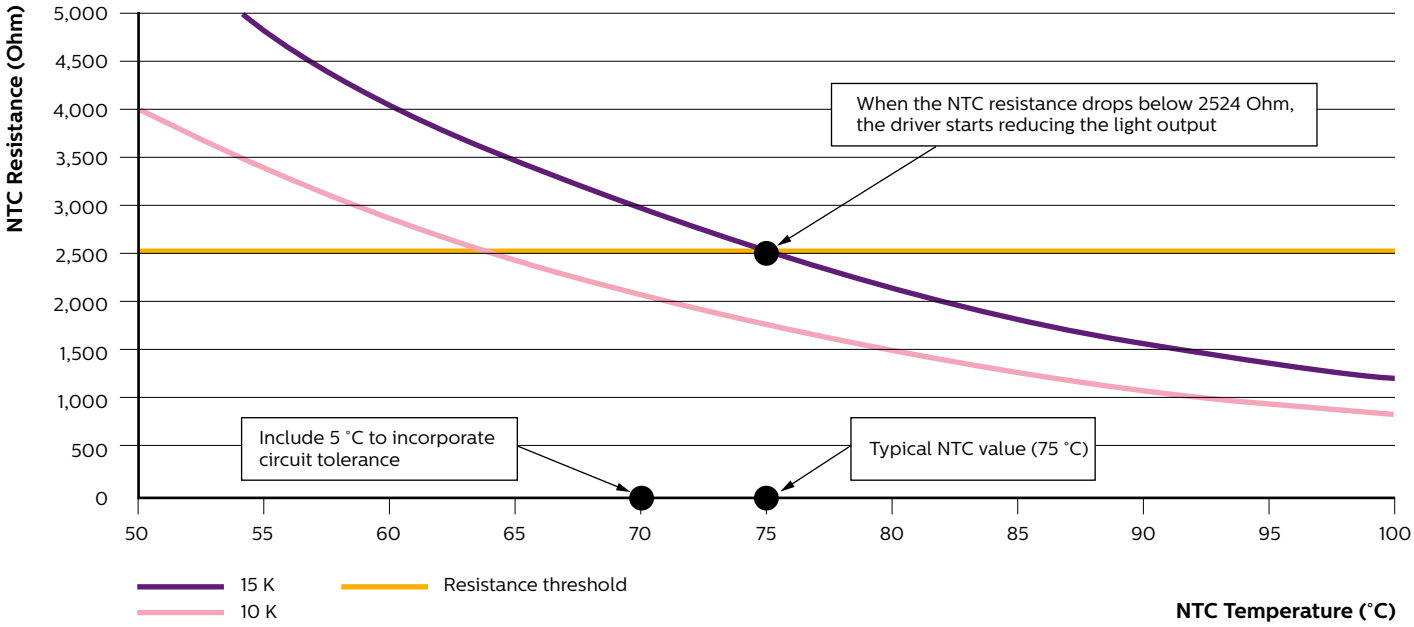
It is possible to set the temperature at which the MTP feature is activated, defined by “MTP warn” and the slope, defined by “MTP max”. Using the MultiOne Configurator software these settings can be changed.

Setting the thermal de-rating point via NTC

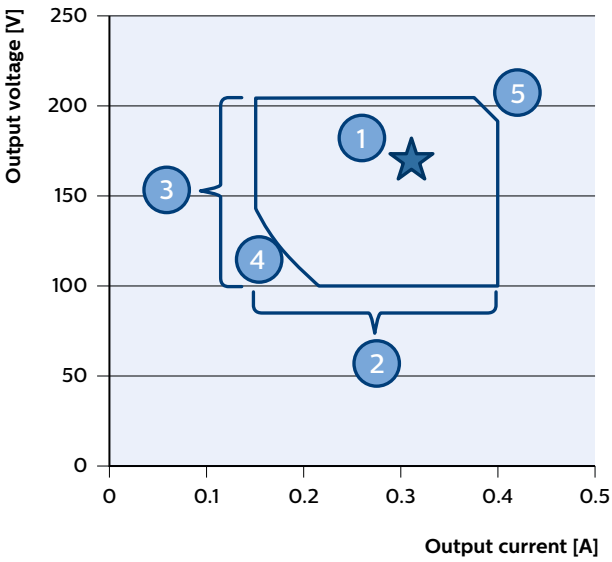
The driver will start reducing the light output when the NTC reaches a value of 2524 Ohm. The NTC should be selected such that 2524 Ohm represents the critical temperature of the LED module/PCB in the application.
For example: An LED module has a defined Tc life at 70 ˚C. Taking into account the typical tolerances of the NTC of ±5 ˚C, this gives a typical value for the NTC of 75 ±5 ˚C. By choosing this setting of 75 ˚C, we ensure that the driver will not dim the output, due to a too high temperature, before the module reaches 70 ˚C. The following graph shows a typical R vs. T curve of an NTC resistor. To match 2524 Ohm at this temperature, the NTC of 15 kilo-Ohm has been selected.

Note: the driver NTC interface has its own ground reference. For proper MTP functioning it is not allowed to combine the NTC ground wire with the LED – ground wire.

Note: the length of the two NTC wires between driver and LED module is not allowed to exceed 60 cm due to EMC and noise immunity reasons.



Electrical Design-In



1. Required set point for the LED solution
2. Current can be set to needs within range
3. Driver adapts to required voltage, given it fits range
4. Driver minimum power limit
5. Driver maximum power limit

Example Operating window of a Xitanium SR driver

Note: by means of dimming it is possible to go below the minimum value of the specified output current.

Xitanium Driver Operating window

LED technology is rapidly evolving. Using more efficient LEDs in a next generation means the same light output can be achieved with lower currents. At the same time, LEDs can be driven at different currents levels based on the application requirement. Typically, LED drivers are available in discrete current levels, e. g. 350 mA, 530 mA or 700 mA. It is often necessary to replace a driver when more efficient LEDs or different LED boards become available.

One of the key features of the Xitanium LED SR drivers is the adjustable output current (AOC), offering flexibility and future-proof luminaire design. The Xitanium drivers can operate in a certain “operating window”. This window is defined by the maximum and minimum voltage and current that the driver can handle. An example of an operating window is shown on the left. The area indicates the possible current/voltage combinations. The current selected will depend on the type and manufacturer of the LEDs or the specific LED configuration of the PCB design. The voltage is the sum of the LEDs used (total Vf string). The operating window of every driver can be found in the driver datasheet which can be downloaded at www.philips.com/technology.

The output current of these drivers can be set in two ways.

1. SimpleSet: output current can be set using the Philips MultiOne software and SimpleSet interface.
2. SR interface: output driver current can be set using the DALI-2-USB interface. More information can be found at: www.philips.com/multione.

To Select an Appropriate Driver

Depending on your requirements, several drivers can be a solution for you. The following steps can help you in selecting a driver. For a complete overview of the available drivers, please refer to the website : www.philips.com/technology.

1. Determine your required driver current (Idrive) and voltage (Vf)
2. Calculate the required power (Pdrive) where Pdrive = Vf x Idrive (W)
3. Select the datasheets from the website mentioned above based on the driver having a higher power than required.
4. Does the required current fit the current range of the driver? The current range of the driver can be seen in the name itself. For example, for driver Xi SR 75 W 0.2 – 0.7 A SNEMP 230 V S240 sXt, the minimum programmable driver current is 0.2 A and maximum is 0.7 A.
   - Idriver min ≤ Idrive ≤ Idriver max?
5. Does the required voltage fit the voltage range of the driver? The exact value can be found in in the datasheet.
   - Vdriver min ≤ Vf ≤ Vdriver max?
6. Does the required power fit the power range of the driver? In the naming of the driver, you can see the maximum possible output power. For example, for driver Xi SR 150 W 0.2 - 0.7 A SNEMP 230 V S240 sXt, the maximum output power is 150 W.
   - Pdriver min ≤ Pdrive ≤ Pdriver max?
7. Choose your preferred dimming. Please refer to the section about naming of the drivers to know what the naming tells you about the possibilities.

Programming the output current

The Xitanium LED SR drivers offer a full range of controls, enabling customizable luminaire design and performance. It is possible to control light output levels and set system specifications in the factory and even in the complete installations.
This can be done with the Philips MultiOne configurator. The MultiOne configurator is an intuitive tool that unlocks the full potential of all programmable drivers from Philips, ensuring that the driver performance matches the needs of the lighting solution. It offers unprecedented flexibility, before, during and after the product installation.
Programming of new Xitanium LED SR drivers can be done through both the SR interface and SimpleSet.
For more information on MultiOne go to the chapter Configuring Your Driver or visit: www.philips.com/multione. This site contains detailed information on how to install the software and how to program the driver.

Connectors

Philips Xitanium LED SR drivers are equipped with push-in connectors. More info about connectivity (wiring diagram, wire diameters, strip length) can be found in the driver datasheet.
In some scenarios two wires need to be connected to one connector terminal. In this case, the pairing has to be done outside the driver, resulting in only one wire going into the connector terminal. Two wires into one connector terminal are not supported.
The reliability of twin-wire ferrules (or wire end stop), accepting the wires intended to use, should be checked with the supplier of these ferrules.

Mains operating conditions

Xitanium LED SR drivers are designed to withstand high and low mains voltages for a limited period of time.
This includes under- and overvoltage due to malfunction such as a loose neutral wire in the grid.

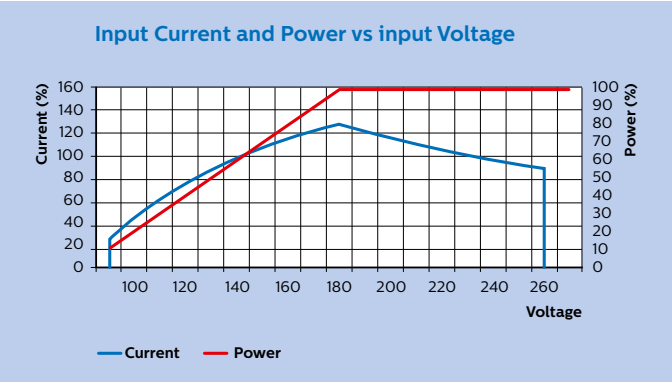
Low and high mains voltage

Xitanium LED SR drivers are designed to be operated at mains under- and overvoltage per IEC requirements for performance and operation with respect to specified rated input voltage range. The applicable lower limit for driver performance is lowest rated voltage - 8 % while -10 % applies to driver operation." The applicable upper limit for driver performance is highest rated voltage +6 % while +10 % applies to driver operation. The actual limit values can be found in the driver datasheet. For optimal luminaire performance it is always recommended to operate drivers within the specified voltage performance range.

Excessive low mains voltage (MainsGuard)

Xitanium SR outdoor and industry drivers have a built-in feature to protect luminaire and mains grid without loss of lighting or the occurence of overcurrent conditions. This smart feature is called MainsGuard. Its function is to limit the maximum output power when the mains voltage drops below a certain value and to keep doing so all the way down to 90VAC before the driver output is eventually shut down. A small hysteresis (5 ... 10 V) is added before the driver output becomes active again once the mains voltage starts to increase.

A general graphical representation of MainsGuard can be seen in the illustration on the left while exact (fixed) values can be found in the MainsGuard graph in the driver datasheet.



MainsGuard feature for Xitanium SR Outdoor and Industry Drivers

Main benefits of MainsGuard are:

- Light will remain on, even at excessive low mains voltage
- Luminaire and grid are protected against undervoltage and overcurrent
- The maximum input current is limited to max 130%, preventing overcurrent in the mains grid and tripping of MCBs and/or fuses

Note: the voltage levels at which output power is reduced and the output is eventually shut down and re-activated are fixed and cannot be reprogrammed.

High mains voltage

A high mains voltage will stress the driver and have an adverse effect on the lifetime (maximum of 264-320 VAC for a period of 48 hours, 321-350 VAC for a period of two hours and 400 VAC for 5 minutes). A loose neutral condition has to be avoided as this will reduce the lifetime dramatically.

Power grids

Xitanium LED SR drivers are suitable for direct connection to TN, TT and IT grids. An external luminaire-based fuse in the driver neutral connection is required in case both feeding phases are “hot”.

Note: certain restrictions apply for use in IT grids. Direct connection of Xitanium LED SR drivers is only permitted in delta connection with a phase-to-phase voltage of 230 V. In case the drivers are connected in star connection in a 230 V/400 V IT grid, the use of a separate 1:1 insulation transformer with sufficient power rating is required to power the drivers. The secondary output of the transformer needs to be connected to earth.

DC Emergency operation(DCemDim)

Depending on driver type, the driver is released in compliance with lamp control gear standard IEC 61347-2-3 Part J. As a result, the driver is suitable for emergency luminaires in compliance with IEC 60598-2-22, excluding high-risk task areas.

The DC Emergency Dim feature named allows a pre-defined dim level of the driver output to which the driver switches over automatically once connected to a DC input voltage.

The mains input of DC-rated drivers is not polarity-sensitive for DC input voltage and the driver is fully CISPR15 compliant when operated on a DC grid. Specific DC input voltage values can be found in the driver datasheet.

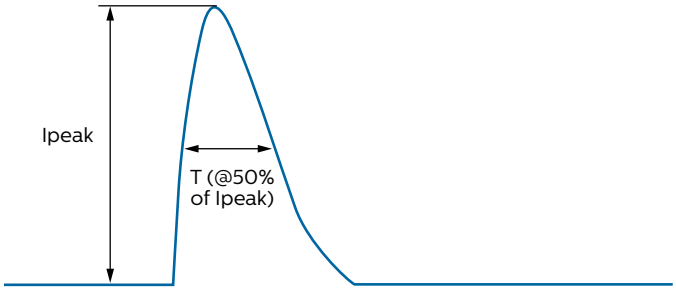
The use of an external, luminaire-based DC rated fuse with sufficient DC voltage/current rating and breaking capacity is required.

Suggested fuses (per each driver):

- 3.15A 400VDC 1.5kA BC, 5x20mm Slo-Blo® 477 series from Littelfuse
- 3.15A 250VDC 10kA BC, 5x20mm Fast 7008913,3.15 from Siba
- 3.15A 400VDC 30kA BC, 6.3x32mm gPV 7006526,3.15 from Siba

More on setting parameters of DCemDim can be found in the section for Controllability. Specific DC input requirements can be found in the driver datasheet

Note: The allowed DC input voltage range accepted by the driver is stated in the driver datasheet. Values outside that range will have an adverse effect on the driver performance and reliability.



Graphical representation of inrush current

Inrush current

The term 'Inrush current' refers to the briefly occurring high input current which flows into the driver during the moment of connection to mains; see the illustration on the left. Typically, the amplitude is much greater than the steady-state input current.

The cumulative inrush current of a, given, combined number of drivers may cause Miniature Circuit Breakers (MCB) to trip. In such a case, either one or a combination of the following measures need to be taken to prevent nuisance tripping:

1. Replace existing MCB for a less sensitive type (e.g. exchange B type for C type) if in accordance with electrical national standards.
2. Distribute the group of drivers over multiple MCB groups or phases
3. Power up drivers sequentially instead of simultaneously
4. Install external inrush-current limiting devices
5. Install a zero crossing relay to power up the drivers

Inrush parameters are driver-specific and can be found in the driver datasheet.

Note: The amplitude and pulse time of the inrush current are not in any way affected by the driver feature Adjustable Startup Time (AST, see chapter Control Features).

MCB type	Rating (A)	Relative number of LED drivers (%)
B	16	100 (stated in datasheet)
B	10	63
B	13	81
B	20	125
B	25	156
C	16	170
C	10	104
C	13	135
C	20	208
C	25	260
L, I	16	108
L, I	10	65
G, U, II	16	212
G, U, II	10	127
K, III	16	254
K, III	10	154

Conversion Table for maximum number of drivers on Different types of Miniature Circuit Breakers.

To Determine the Number of Drivers on a MCB

The maximum amount of drivers on a 16 A type B Miniature Circuit Breaker (MCB) is stated in the driver datasheet.
In the conversion table on the left that stated amount is used as reference (100%).
The maximum quantity of drivers on different types of MCB can be calculated by the reference (see driver's datasheet) x Relative number (last column).

Example;
If datasheet states: max number on type B, 16 A = 20, then for type C, 13 A the value will be 20 x 135% = 27.

Notes:

1. Data is based on a average mains supply with an impedance of 400 mΩ + 800 μH. This is in most cases equal to a prospective short circuit current of 500 Amps. Deviating mains impedance is of minor importance regarding the maximum amount of drivers per MCB
2. Measurements will be verified in real installations; data is therefore subject to change.
3. In some cases the maximum number of drivers is not determined by the MCB but by the maximum electrical load of the installation.
4. Note that the maximum number of drivers is given when these are all switched on at the same time, e.g. by a central relay.
5. For multiple MCBs in one cabinet use the derating tool of the manufacturer of the MCB's for steady- state load. No derating is needed in respect to inrush current as this is not part of the thermal properties of the cabinet.
6. The maximum number of drivers that can be connected to one 30 mA Residential Current Detector is typically 30.

Surge immunity

Indoor

The Xitanium Indoor SR drivers have limited built-in surge protection. Depending on the mains connected, additional protection against excessive high surge voltages may be required by adding a Surge Protection Device. The actual limit can differ per driver and can be found in the driver's datasheet in the download section on
www.philips.com/technology.

Outdoor

The Xitanium outdoor SR drivers have increased differential-mode and common-mode surge immunity levels which by far surpass the limits as defined by IEC. The driver EQUI terminal must be connected to the metal parts of the luminaire and LED module heatsink in all cases (Class I: also to earth) to safeguard the specified immunity levels. Doing so will guarantee the specified driver surge immunity levels and will protect the LEDs against surge damage. Depending on the local conditions, additional protection against excessive high surge voltages may be required by adding an external Surge Protection Device in the luminaire and/or at

installation level. The actual driver immunity level can differ per driver and can be found in the driver datasheet.

Touch current

The Xitanium LED SR drivers are designed to meet touch current requirements for insulation class II applications per lighting control gear standard IEC 61347-1. The specified peak values can be found in the driver datasheet and refer to single-driver only level.

The insulation of the wiring to and from the drivers needs to be in compliance with IEC60598. Taking into account the double insulation of the driver between mains input and LED output, the (supplementary) output wiring insulation rating needs to be based on the maximum open-load voltage of the driver. See the driver datasheet for the specific value.

Note: In a luminaire, the cumulative touch current may be higher, since the LED module may introduce additional touch current. Precautions may be required on the luminaire level if multiple drivers are used in a single luminaire.

Note: do not leave the EQUI terminal open in order to lower the luminaire touch current. Impaired EMC performance and reduced surge immunity will result!

Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC) is the ability of a device or system to operate satisfactorily in its electromagnetic environment without causing unacceptable interference in practical situations. Xitanium LED SR drivers meet EMC requirements per CISPR15. This test is conducted with a reference setup that includes a driver and an LED load/heat sink combination mounted on a metal plate.

Note: the driver EQUI terminal must be connected to the luminaire chassis (Class I and II) as well as to Protective Earth (Class I) for optimal EMC performance.
Doing so for Class II luminaires/systems is in safety compliance with IEC61347-1, IEC60598-1 and IEC61140 regarding the relation between the driver EQUI terminal and live parts with respect to:

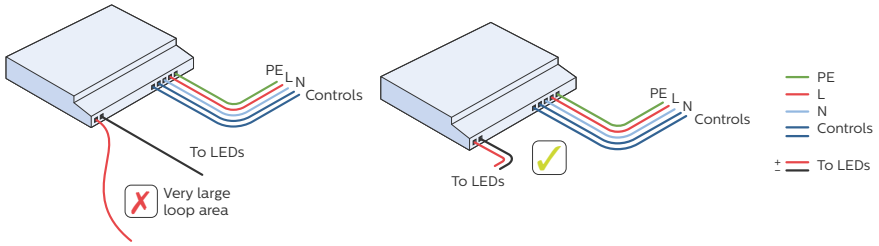
- Maximum allowable touch current
- Minimum required insulation resistance
- Minimum required creepage distances & clearances
- Minimum required electric strength”

Note: the driver EQUI terminal does not have a safety function.

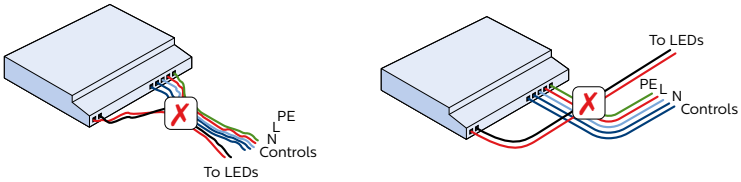
Improvement in EMC Performance

The following practical precautions need to be taken into account in a lighting system for optimal EMC performance:

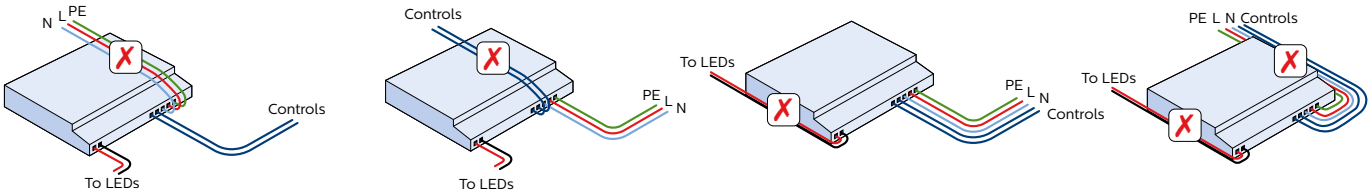
- Minimize the differential mode loop area of the output wires going from the driver to the light source by keeping the wires close together (bundling). This will minimize the magnetic field and reduce the radiated EMI.



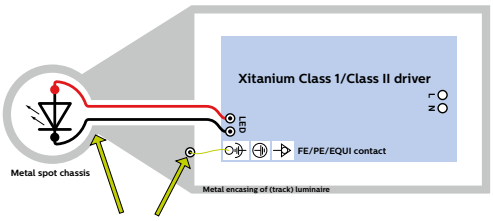
- Minimize the common mode parasitic capacitance of the output wiring + light source to earth by keeping the length of the wires between driver and LED module as short as possible. Keep the length of the incoming mains wire inside the luminaire as short as possible.
- Keep mains and SR control wires separated from the output wires. Do not bundle or cross the wires.



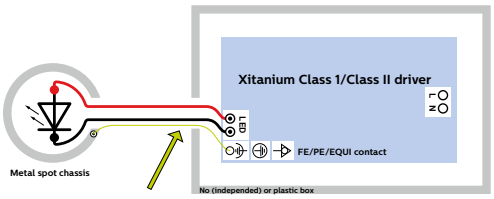
- **Do not route any wiring over and/or along the driver enclosure to avoid any coupling/crosstalk with internal components of the driver**



- Ground the lighting system chassis and other internal metal parts (mounting plate, heatsink) to protective earth (class I luminaires). Do not keep large metal parts electrically insulated from the driver equipotential connector (EQUI). **Always** connect the driver EQUI terminal and use equipotential bonding wires for all large unconnected metal luminaire parts like luminaire housing, driver mounting plate, reflector, heatsink etc. Keep the equipotential wires as short as possible to maximize their effectiveness and use, as much as possible, large metal areas (chassis, mounting plates, brackets) for earthing purposes instead. Establish a reliable electrical connection by using a toothed washer and screw(s) fastened with adequate torque.



Luminaire housing connected to FE/PE/EQUI contact of driver



Metal spot chassis of an independent configuration connected to FE of driver

Adhering to these rules will help in EMC compliance. For further questions and/or design-in support please contact your local Philips representative..

Remote mounting and EMC

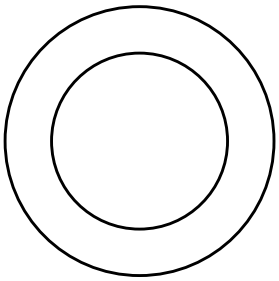
Remote mounting of Xitanium LED SR drivers is allowed as long as the additional summarized voltage drop as function of output current along the LED + and LED – wires is accounted for.

Philips has successfully performed CISPR15 compliance EMC tests on systems with a standard output cable length of 60cm as reference. For longer CISPR15-compliant cable lengths please check the driver datasheet for the maximum specified length.

Note: the length of the two NTC wires between driver and LED module is not allowed to exceed 60cm due to EMC and noise immunity reasons.

Electrical insulation

Driver insulation classifications between the several inputs and output can be found in the driver datasheet. The insulation classification between the EQUI terminal and the mains input is **double** for all Xitanium LED SR drivers.



Symbol for double isolation between primary and secondary side of the driver, in combination with build-in usage.

Isolated indoor drivers (SELV output)

These drivers cannot generate output voltages higher than 60 VDC. By design these drivers are intended for built-in use, not suited for independent use. The driver must be placed in a suitable adequate enclosure according to the applicable norms and standards. Hence the double circle symbol is to be used, not the double-square symbol (Amendment 2 of safety standard IEC61347-1). However, these isolated drivers (SELV output) can be used in both Class I and Class II luminaires under the following conditions:

- When used for Class I the protective earth connection should be present (see previous section “Non-isolated drivers”).
- When used for Class II (and SELV), the driver should be incorporated in the luminaire in such a way that
  - a) The driver housing is electrically insulated with respect to electrical conductive materials, such as the housing or reflector and as such not touchable during installation or operation.
  - b) All metal luminaire parts (chassis, heat sink, metallic reflector) connected to the driver housing are not allowed to be accessible by bare hand, or
  - c) Any accessible conductive luminaire parts should have basic isolation towards the non-accessible luminaire parts and/or driver housing.

Note: for Class II, EMC requirements should be met without PE connection and particularly also any functional earth connection from driver to accessible fixture/chassis is strictly prohibited, as it will form insufficient (non-single fault-proof) insulation with respect to live parts connected to the driver.

Xitanium Indoor SR drivers meet the IEC 61347-1 safety standard In accordance to this standard, the following safety requirements are met:

- Basic isolation between the Primary and Secondary side wires:
- Driver output voltage < 1000 VDC
- Insulation test voltage 1500 V (1000 V + 2 X 250 V)
- Double isolation between all wires and chassis: Insulation test voltage: 3750 V.

Indoor SR drivers as “independent” drivers

By design the Xitanium Indoor SR LED drivers are intended for built-in use, not suited for independent use. The driver must be placed in a suitable adequate enclosure according to the applicable norms and standards when used independently.

SR (Sensor Ready) Interface

SR driver connected to a sensor

Sensor Ready Interface

Xitanium LED SR drivers reduce complexity and cost of luminaires used in (wireless) connected lighting systems. They feature a digital SR interface to enable direct connection to any suitable CMS controller or sensor (see Figure on the left that uses the example of an indoor SR driver.). Functionality integrated into the SR driver eliminates auxiliary components such as power supplies and relay boxes used in many typical outdoor lighting controllers (OLC) today. The result is a simpler, less expensive luminaire that enables turning every luminaire into a wireless node and a more reliable DC powered controller.

The simple two-wire SR interface supports these key functions:

- Switchable built-in SR bus power supply to provide power to the connected control device (e.g., an RF module or an OLC))
- Two-way digital communication between the SR driver and control device, using standard DALI 2.0 protocol
  - Standard DALI dimming, ON/OFF and control functions
  - Power and energy reporting utilizing the power monitoring integrated in the driver
  - Diagnostic information

Built-in SR bus power supply SR supply:

- The SR driver has the ability to supply the SR bus with a built-in power supply that can be turned ON/OFF. By default the power supply is turned on and ready to be used with an external control device (eg., RF sensor).
- This should in principle be turned off if used in DALI networks with multiple drivers to avoid that wrong polarity can lead to very high currents on the DALI bus. However, we do not recommend to use this driver in a wired DALI network. For this purpose FP or TD drivers are made
- The internal power supply can be turned ON/OFF with the MultiOne configuration software using the SimpleSet tool or the SR interface (DALI) tool.
- The built-in SR supply is capable of delivering a minimum current of 52 mA (ISR) to the SR bus and the connected device(s).
- The built-in SR supply will never supply more than 60mA (ISR_MAX).
- The SR bus voltage will be between 12 V and 20 V depending on the connected device load and the amount of SR supplies put in parallel. See the graph below for the typical VI curve for one SR supply.
- When the internal SR supply is switched OFF the SR driver will extract a maximum of 2 mA from the SR bus (like standard DALI gear).

Control device(s):

- Most control devices intended to be used in an SR system will be powered from the SR bus or the 24 V auxiliary power supply.
- When communication is present on the SR bus, the bus gets pulled down by the data packages. This reduces the average current available for the power consuming control device. When communicating the average available current can drop with 50%. This should be taken into account when designing the control device.
- The extracted peak current (ISR_EXTRACTED) should be limited by the control device.

Rules for building an SR system:

- Respect SR bus polarity when more than one SR supply is connected in parallel.
- The total maximum SR bus current (ISR_MAX_TOTAL) must be ≤ 250 mA. This current can be determined by adding ISR_MAX of all SR supplies. As a consequence a maximum of four SR supplies can be connected in parallel.
- The total current delivered to the SR bus (ISR_DELIVERED) can be determined by adding ISR of all SR supplies.
- The total current extracted from the SR bus (ISR_EXTRACTED) can be determined by adding up consuming devices like SR drivers with switched OFF SR supply, other DALI gear and control devices.
- To guarantee good communication, a margin of 8 mA is needed to drive the SR bus itself (ISR_MARGIN).
- The following rule should be respected: ISR_EXTRACTED + ISR_MARGIN ≤ ISR_DELIVERED.

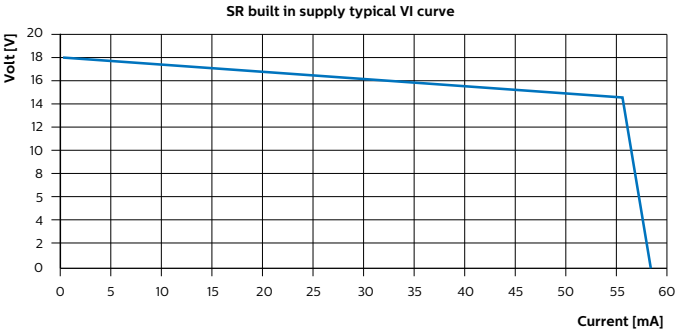
Caution:

- When the above rules are not taken into account, communication cannot be guaranteed and damage to components may occur.

Typical examples:

One SR driver is connected to a control device. The internal SR supply of this driver is switched ON. The specification of the control device states that the extracted peak current is 40 mA. Will this SR system have good communication?

- One SR supply is involved, so BUS polarity is not an issue.
- ISR_MAX_TOTAL = 60 mA. This is ≤ 250 mA
- ISR_DELIVERED = 52 mA
- ISR_EXTRACTED = 40 mA
- ISR_MARGIN = 8 mA
- 40 + 8 mA ≤ 52 mA



Configurable Parameter within the Driver	Configuration (Factory Default)	SimpleSet	SR Interface using MultiOne Tool
Adjustable Output Current (AOC)	•	•	•
SR Power Supply (ON/OFF)		•	•
Standard DALI 2.0 Configurable Parameters			•

Configuration options

Is it allowed to add an SR driver with switched OFF SR supply to this SR system?

- Yes, an SR driver with switched OFF SR supply extracts 2 mA from the SR bus.
- ISR_EXTRACTED = 40 + 2 = 42 mA.
- 42 + 8 mA ≤ 52 mA

Can this SR supply also be switched on?

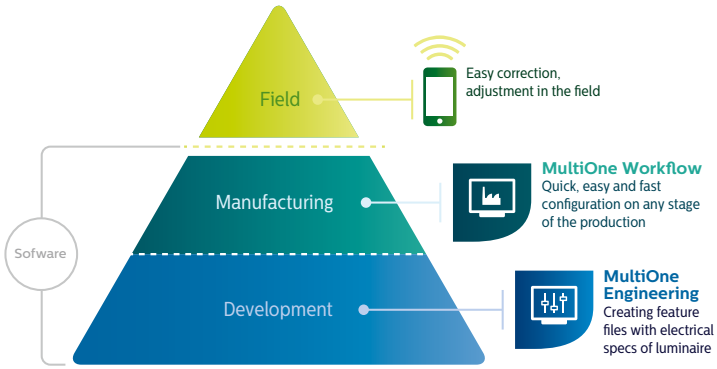
- Yes, but you should check the polarity of both SR supplies.
- ISR_TOTAL = 2 * 60 = 120 mA. This is ≤ 250 mA.

Digital communication:

Dimming is possible through the standard digital interface based on DALI 2.0 (IEC 62386 101, 102 Ed2.0) protocol.

- Note that the output current at 100% level is determined by the driver. The minimum current that can be supplied by the driver is specified in the datasheet. The lowest dim level is defined by the higher of the two values: Minimum output current or 10% dim level.
- The SR driver has built-in energy measurement capability and can report energy and actual power consumption. Accuracy of power measurement is higher of following 2 values: 0.5W or +/-1 % measured input power. This feature stores parameters in the non-volatile memory bank provision specified in the DALI 2.0 standard and the SR Certified specification.
- The driver also supports many diagnostic features/ parameters which can be accessed via the SR interface, as per SR Certified specification
- Although the SR interface supports DALI commands, it is not a DALI interface as such since the interface is polarity-sensitive. We do not advise use of the SR driver in wired DALI networks.

Configurability



Introduction

The Xitanium LED SR drivers offer a full range of controls, enabling customizable luminaire design and performance. It is possible to control light output levels, preset dimming protocols and set system specifications in the factory and even in the complete installations.
This can be done with the Philips MultiOne configurator. The MultiOne configurator is an intuitive tool that unlocks the full potential of all programmable drivers from Philips, ensuring that the driver performance matches the needs of the lighting solution. It offers unprecedented flexibility, before, during and after the product installation.
Programming ofthe Xitanium LED SR drivers can be done by both the SR interface and via SimpleSet. In the name of the driver you can see which interface is supported.

For more information on:

- MultiOne- installation – software and programming: www.philips.com/multione
- Driver - feature set and default settings: datasheets: www.philips.com/oem
- Specific features: design in guide of that driver: www.philips.com/oem

This chapter describes the way drivers can be configured using the MultiOne Configurator.

Please check the datasheet of the driver on www.philips.com/technology to verify if the selected driver supports specific configurability.

MultiOne characteristics

The characteristics of the MultiOne configurator are:

- One tool for all Philips configurable drivers: Xitanium LED Indoor and Outdoor drivers; HF-R Indoor fluorescent gear; DynaVision Xtreme HID electronic gear...
- Future proof by design: modular approach, very scalable and backwards compatible
- Provides access to all features built in the driver
- Tool combines configuration with debugging
- Settings of the drivers can be changed any point in the product lifecycle.
- Settings of the drivers can be changed at any point in the product lifecycle (if allowed- see OWP feature)

Basis blocks

This configurator consists of:

1. Philips MultiOne Interface Tool.
2. USB cable (connection to PC or laptop).
3. Philips MultiOne Software.

MultiOne Interface DALI LCN8600

Philips MultiOne Interface tool

There are different versions of MultiOne interface tooling depending on the type of communication:

1. LCN8600/00 MultiOne Interface USB2DALI

The interface that can be used with the MultiOne PC software to commission, configure, diagnose drivers via the DALI interface.

2. LCN9610 and LCN9620 SimpleSet interface

The interface that can be used with the MultiOne PC software to configure drivers wirelessly using SimpleSet technology.

3. More interfaces are coming up ...

SimpleSet interface tool LCN9620

SimpleSet interface tool LCN9610

Note: SimpleSet

The programming of the Xitanium LED SR drivers with SimpleSet must be done while disconnected from mains.

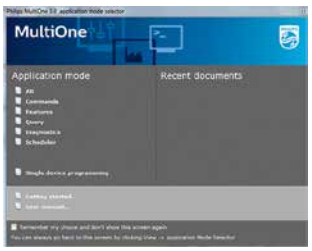
When powering up the driver – during first use after configuration - apply the specified mains voltages for at least 1 second.
If the applied mains voltage is below the specified minimum value of the driver and the duration is less than 1 second it is possible that the new setting is not programmed into the drivers EEPROM.

Philips MultiOne Interface Tool

When ordering the MultiOne Interface, the correct USB cable will be supplied with the interface tool.

Each interface tool has its own cable.
Check if USB ports of the PC are able to power the interfaces .

When ordering the MultiOne Interface, the correct USB cable will be supplied with the interface tool.



Philips MultiOne Software

There are 2 versions of MultiOne Software depending on functionality and location:

1. MultiOne Engineering

Especially developed to access all functionality of the driver; to configure, diagnose and prepare the configuration file for the production environment. Includes also:

- DALI commands, scheduler.
- SimpleSet .

2. MultiOne Workflow

Developed to configure all devices or subassemblies in the production environment or field in a simple and quick way. Workflow exists of 2 packages:

- Worfklow GUI (direct use)
- CommandLine (integration in test bench, robot,automation,...)

Get your software (free downloadable) or check if you have the latest version www.philips.com/multione.

System requirements

The MultiOne configurator must be connected to a system with these minimum system requirements:

- Windows PC or Laptop.
- Microsoft Windows 7, 8.0, 8.1.
- USB 2.0 or 3.0 ports (minimum two free ports).
- Min 45 MB of free disk space.

Note: The software may work well with Windows 10 but possible Windows bugs can affect the good functionality of the MultiOne software. USB ports of the newest PCs and laptops may have the problem of not delivering enough power to the interfaces. Please check this before supplying new systems.

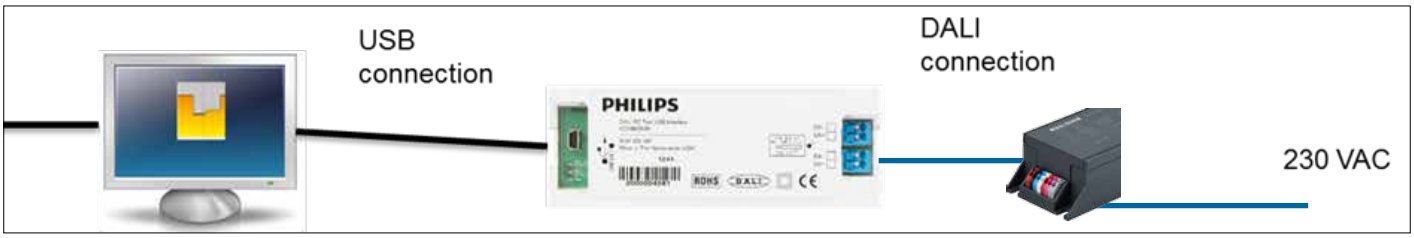
Getting Started

Connect the USB cable of the MultiOne Configurator between the PC and the configuration tool.
To install the software, launch the installation file for the latest version and follow the instructions on your screen. The installation wizard will guides through the process of installing the software and will asks where the software needs to be installed, if a shortcut is needed on the desktop and a new program is also created in the Start Menu.

A User Software key is required to install MultiOne Engineering (available at no charge).
This key can be requested here:
www.lighting.philips.co.uk/oem-emea/products/philips-multione-configurator/multione-configurator-form.html

More information on how to program a driver, can be found in getting started and the instruction manual on the website: www.philips.com/multione.

MultiOne System



Settings

The Xitanium LED SR drivers have a fixed set of features and factory settings when supplied. The set of features is defined in the datasheet of the driver.
The default settings of the driver can be found in the driver's datasheet in the download section on: www.philips.com/technology.

More information of using Multione

On our up to date website www.philips.com/multione you can find:

- All interface tools with order codes
- Software free to download
- All manuals; getting started; Simpleset explained; instructions manuals

Request User software key:

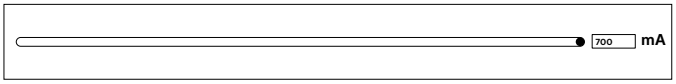
- www.lighting.philips.co.uk/oem-emea/products/philips-multione-configurator/multione-configurator-form.html

Controllability

How to program the features is explained in the User Manual guide of MultiOne; see the Help function of MultiOne or download it from: www.philips.com/multione. In this chapter the features will be explained in more detail. Please check the datasheet of your driver to know which features are available for your driver and what the default setting for each feature is.

Adjustable output current (AOC)

AOC limits the driver output current to match the application requirement.
The limited output current is then dimmable over the full user controllable dim range; the AOC level [mA] being the 100% light level.

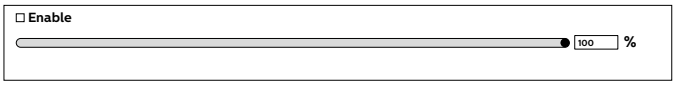


Adjustable Light Output (ALO)

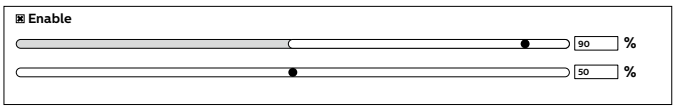
ALO limits the light output of the driver to match the application requirement. The limited light output is then dimmable over the full user controllable dim range; the ALO level [%] being the 100% light level.

There are 2 versions depending on driver type:

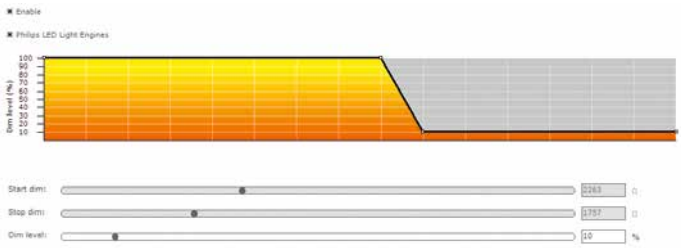
- ALO



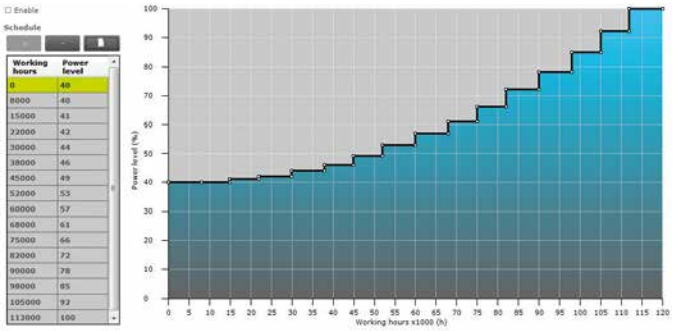
- ALO and ALO min



Check the driver datasheet to verify which ALO type is available.



MTP



CLO

LED Module Temperature Protection (MTP)

MTP is the method in which a thermal sensor (NTC resistor) implemented on the LED module board is sensed by the driver, which will reduce output current when a predefined (temperature) limit is exceeded in order to protect the LED module from thermal overstress.

The driver accommodates for three prescribed NTC resistor types. See chapter Thermal Design-In for more details on NTC type.

Constant Light Output (CLO)

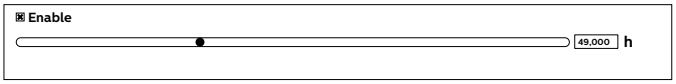
CLO will gradually increase the light level over time from an initial lower light level up to 100% light level in order to compensate for LED module depreciation over life. It can also serve as a means to reduce energy consumption.

CLO settings includes enabling disabling and redefining the CLO dimming curve. Changes are effective immediately.
The allowed range for CLO is 0-100% with 1% increments (note that 0% results in the LEDs being switched off).

End of Life (EOL)

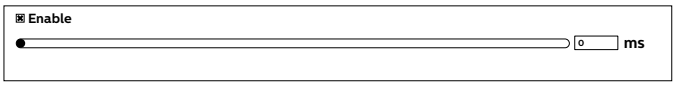
EOL is providing a visual notification to a customer that the LED module has reached the end of manufacturer-specified life and that replacement is recommended.

Once active, an indication is given at each power-up of the driver, where the LEDs will flash for 2.5 seconds after which normal operation is continued.



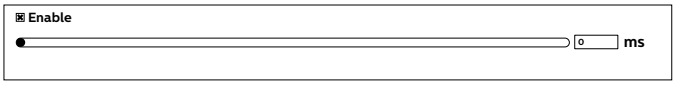
Adjustable Start up Time (AST)

AST enables gradual increase of light level at power-up of the driver, ensuring a smooth and comfortable transition from daytime to evening illumination.
AST can be programmed to a value between 0 s and 30 s, in increments of 1ms.



Light Source Operating (LSO)

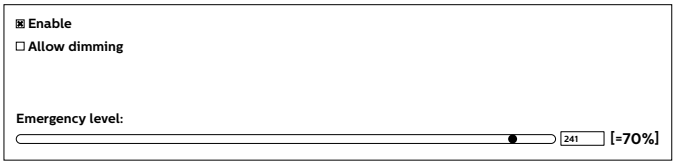
Light Source Operating: set a specific time or reset the operating hours, e.g. after replacing a LED module with another (new) one.
When CLO enabled it is recommended to set the correct light source age.



DC emergency dimming operation (DCemDIM)

The Xitanium LED SR drivers are equipped with a configurable auto-detect DC voltage feature. As soon as a DC input voltage is detected by these drivers, it will automatically set the output current to a predefined configurable emergency dim level.

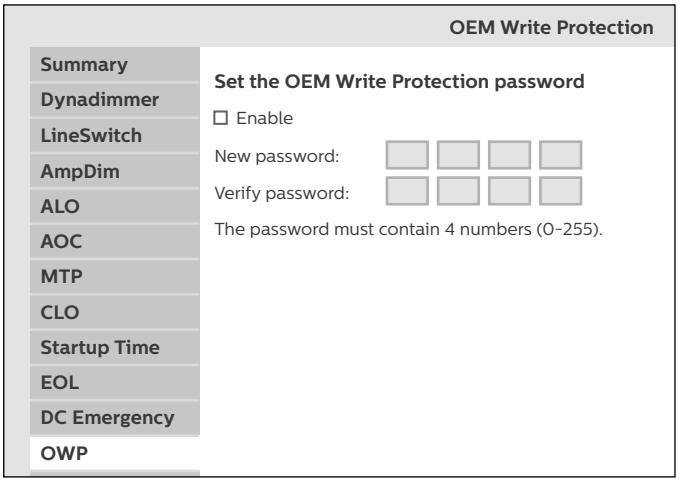
Note: during DC operation the output current cannot be set higher than 60 % of the programmed AOC value applicable during AC operation and the driver will ignore all DALI commands unless the optional checkbox “Allow dimming” in the DC Emergency tab is selected.



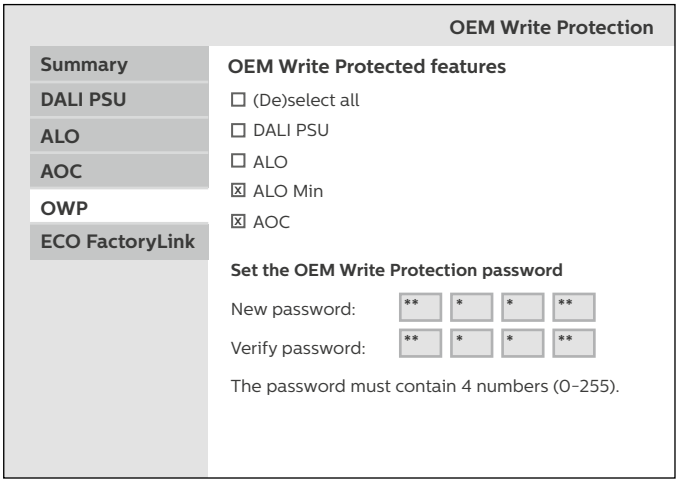
Amplitude Modulation (AM) output dimming

Philips Xitanium LED SR drivers dim the output to the LEDs by means of Amplitude Modulation (AM) dimming. This means that at no stage of the dimming, Pulse Width Modulation (PWM) at the output to the LEDs is applied. AM dimming guarantees the most smooth and flicker-free operation over the entire dimming range.

Group of features - OEM protection



Individual features - OEM protection



OEM Write Protection (OWP)

OWP can be used by the OEM to protect the change of setting of the Philips programmable driver.
Philips Drivers equipped with the feature OWP will show this in their feature list, if read out via the MultiOne Engineering Software.
The feature OWP defines a password that will be set in the driver so the data of OEM Write-protected features can only be written to the driver by providing this configured password.
Depending on the type of driver OEM can protect

- a set of features (fixed)
- a selection of individual features (free selection)

To know which features are locked you see a small lock symbol on each feature while trying to write the driver.

How to program this feature is described in the user manual of MultiOne Engineering at: www.philips.com/multione.

The password is needed to change the protected features of this driver. Without the password these features are not changeable.

Encrypted in the feature file, the password can be easy programmed in production via the MultiOne workflow software. New drivers or replacement drivers can be programmed on this way. Already programmed drivers with password are protected and will give an error. They can only be changed using the correct password.

It is important for the OEM to set up a password management system, keeping feature file and password together in the BOM of the luminaire. The password management is under the responsibility of the OEM who sets it.
In case of losing the password, the customer can take contact with the local sales department to discuss a possible solution.

Quality

For certificates and approvals please go to the download page on: www.philips.com/technology.
For specific national certification please contact your local Philips sales contact

Disclaimer

Philips will perform the testing of the LED systems to high standards of workmanship. The tests are carried out with reference to the EN/IEC standards, if any, which are regarded by Philips as being of major importance for the application of the lamp gear and the lamp within the fixture for horticultural applications.
The design-in guide, regarding the testing and design in of the LED system provided by Philips, is not an official testing certificate, and cannot be regarded as a document for official release of the fixture. The OEM is liable for the official testing by a certified test body and all markings, such as CE and ENEC marks, on the fixture assembly.
The design-in guide is for information purposes only and may contain recommendations for detecting weak points in the design of the system (lamp – lamp gear – fixture), if any.
Specifically mentioned materials and/or tools from third parties are only indicative: other equivalent equipment may be used but it is recommended that you contact Philips for verification.
Philips will not be liable for unforeseen interactions of the proposed solutions when applied in the fixtures or applications using these fixtures.
Philips has not investigated whether the recommendations are or will in the future be in conflict with existing patents or any other intellectual property right. Philips does not warrant that its recommendations are technically or commercially the best options.
Since the tests are only performed on one particular fixture provided by the customer, it will be treated as a prototype. This means that there is no statistical evidence regarding later production quality and performance of the lamp – lamp gear – fixture system.
As Philips does not have control over manufacturing of the fixtures, Philips cannot be held liable for the fixture assembly.
Philips will not accept claims for any damage caused by implementing the recommendations.
No warranty whatsoever may be claimed by the OEM with regard to the content and/or quality of the design-in guide or any other advice, or the conclusions and/or recommendations in the design-in guide or any other document, either express or implied, and Philips expressly disclaims any implied warranties of any kind, including without limitation any warranties of satisfactory quality, fitness for a particular purpose or non-infringement and any warranties regarding the design-in guide or any other advice or the use of the results of any activity performed while testing the fixture with respect to its correctness, quality, accuracy, completeness, reliability, performance or otherwise.
The OEM expressly agrees that test design-in guides are provided by Philips on an 'as is' basis and an 'as available' basis at customer's sole risk and expense.
Philips shall not be liable for any lost profits or lost savings, indirect, incidental, punitive, special, or consequential damages whether or not such damages are based on tort, warranty, contract, or any other legal theory – even if Philips has been advised, or is aware, of the possibility of such damages.
The OEM must bring any claim for damages within ninety (90) days of the day of the event giving rise to any such claim, and all lawsuits relative to any such claim must be filed within one (1) year of the date of the claim.
Any claims that have been brought or filed in conflict with the preceding sentence are null and void.

12/2016
Data is subject to change.

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